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NAMES AND TAXONOMY

PREFERRED NAME

Aphis glycines Matsumura, 1917

TAXONOMIC POSITION

Kingdom: Animalia
Phylum: Arthropoda
Class: Insecta
Order: Hemiptera
Suborder: Sternorrhyncha
Superfamily: Aphidoidea
Family: Aphididae

OTHER NAMES USED

Aphis justiceae Shinji, 1922

BAYER CODE: APHIGY

COMMON NAMES

- English:
soyabean aphid
- French:
puceron du soja
- Germany:
sojabohnen-blattlaus
- Japan:
daizu-aburamusa

NOTES ON TAXONOMY AND NOMENCLATURE

A. glycines was first described by Matsumura in 1917. Only one synonym is known in the literature (Eastop and Hille Ris Lambers, 1976).

HOST RANGE

The winter host of *A. glycines* is *Rhamnus davurica*. The summer host range is limited and restricted to certain Leguminosae. In addition to cultivated soyabean, it has been found on wild *Glycine* species (Wang et al., 1962) and has also been recorded from *Pueraria phaseoloides* and *Desmodium intortum* (Blackman and Eastop, 1985).

Primary hosts: *Glycine max* (soyabean).

Secondary hosts: *Rhamnus davurica*, *Pueraria phaseoloides* (tropical kudzu).

Wild hosts: *Glycine*.

AFFECTED PLANT STAGES

Flowering stage, seedling stage, and vegetative growing stage.

AFFECTED PLANT PARTS

Whole plant, leaves, stems, and growing points.

GEOGRAPHIC DISTRIBUTION

Notes on distribution

A. glycines is widely distributed in the soyabean-growing regions of the Far East. It is common in soyabean in China (Wang et al., 1962) and occurs in soyabean fields in the Philippines (Quimio and Calilung, 1993), Japan (Takahashi et al., 1993), Indonesia (Iwaki, 1979), Thailand (Napompeth, 1978), Korea, Malaysia and North Borneo (Blackman and Eastop, 1985).

List of countries

Europe

Russian Federation: present, no further details (D'yakonov, 1975)

Russian Far East: present, no further details (D'yakonov, 1975)

Asia

China: present, no further details (APPPC, 1987)

Heilongjiang: present, no further details (Wang et al., 1962)
Hong Kong: present, no further details (APPPC, 1987)
Jiangsu: present, no further details (Li & Pu, 1991)
Liaoning: present, no further details (Wang et al., 1962)
Shaanxi: present, no further details (Wang et al., 1993)
Indonesia: present, no further details (Iwaki, 1979; Waterhouse, 1993)
Japan: present, no further details (APPPC, 1987; Takahashi et al., 1993)
Korea, Republic of: present, no further details (APPPC, 1987; Chang et al., 1994)
Malaysia: present, no further details (Blackman & Eastop, 1985)
Philippines: present, no further details (Quimio & Calilung, 1993)
Thailand: present, no further details (Napompeth, 1978; Waterhouse, 1993; APPPC, 1987)
Vietnam: present, no further details (Waterhouse, 1993)

BIOLOGY AND ECOLOGY

A. glycines is heteroecious holocyclic (host-alternating with sexual reproduction during part of its life cycle). Winged sexual forms migrate from soyabeans to the winter host, *Rhamnus davurica*, where they mate and produce eggs which overwinter. Migration back to *Glycine* spp. occurs in early summer. The stem apices and young leaves of growing soyabean are colonized first; later on the aphids are found on the underside of leaves of mature plants. Aphid development is favoured in late June to early July by 22-25°C optimum range of temperatures and RH<78% (Wang et al., 1962). Crowding of apterae (wingless parthenogenetic females) is the main factor in the production of alates (winged parthenogenetic females) on the summer host (Lu and Chen, 1993). Alates are responsible for dispersion to other secondary hosts. Out of a total of 18 generations per year, 15 were on soyabean (Wang et al., 1962).

Apterous and alate virginoparae of *A. glycines* were attracted to volatiles of the winter host (*Rhamnus davurica*) and that of a summer host (*Glycine max*) in a laboratory study (Du, 1992).

Takahashi et al. (1993) described the life cycle in Japan, along with observations on Rhamnaceae occasionally used as alternative winter hosts, particularly *Rhamnus japonica*.

Hybrid offspring from crosses between *A. gossypii* and *A. glycines*, which occasionally occur under both natural and artificial conditions, reproduced parthenogenetically and sexually to complete their life cycle (Zhang et al., 1982).

NATURAL ENEMIES

Notes on natural enemies

Chang et al. (1994) described the primary parasitoids and hyperparasitoids of *A. glycines*, from collections made in the Korean Republic. Out of 117 aphid mummies collected, 27% of adults emerging were primary parasitoids and 50% were hyperparasitoids. *Aphidius cingulatus*,

Ephedrus persicae and *E. plagiator* were the most common primary parasitoids. The dominant hyperparasitoids were *Asaphes vulgaris* and *Ardilea convexa*.

Gao (1985) studied the braconid parasite *Lysiphlebia japonica* in Jilin, China, where an average of 56% (and a maximum of 76%) of individuals of *A. glycines* were parasitized.

List of natural enemies

Parasitoids:

- *Alloxysta victrix*, attacking: nymphs, in Korea
- *Aphidius cingulatus*, attacking: nymphs, in Korea
- *Ephedrus persicae*, attacking: nymphs, in Korea
- *Ephedrus plagiator*, attacking: nymphs, in Korea
- *Lysiphlebia japonica*, attacking: nymphs, in China, Korea

Hyperparasitoids:

- *Ardilea convexa*, in Korea
- *Asaphes vulgaris*, in Korea

Predators:

- *Brumoides lineatus*, attacking: eggs, larvae, nymphs, pupae, adults, in China
- *Cheilomenes sexmaculata*, attacking: nymphs, adults, in Philippines, Taiwan
- *Coelophora saucia*, attacking: eggs, larvae, nymphs, pupae, adults, in China
- *Ischiodon scutellaris*, attacking: eggs, larvae, nymphs, pupae, adults, in Philippines, Japan
- *Mallada basalis*, attacking: eggs, larvae, nymphs, pupae, adults, in Taiwan, China
- *Paragus*, in Philippines

ECONOMIC IMPACT

A. glycines is a major pest of soyabean in China, causing particularly severe damage in the regions of Kirin, Liaoning, Heilungkiang and Inner Mongolia (Wang et al., 1962).

Three periods of damage on soyabean can be recognized: (i) from seedling to blooming stage, when aphid populations reach their highest peak and colonies concentrate on young growth; (ii) in late July, when growth is completed and aphid colonies move lower down the plant to feed on underside of leaves; (iii) from late August to early September, when aphids multiply again before migrating back to the winter host (Wang et al., 1962).

In a study in Zhejiang, China, seedlings of soyabean cultivar Bawangdou were inoculated at the two-leaf stage with 5-220 individuals of *A. glycines* per plant. The number of aphids per plant and plant infestation rate were closely related to yield losses, which were 2.7-51.8% at 5-220 aphids per plant. Aphid infestation at the seedling stage affected yield mainly by reducing plant height and number of pods and seeds (Wang et al., 1994).

A. glycines is a vector of a number of viruses. Li and Pu (1991) found that epidemics of soybean mosaic potyvirus (SMV) in summer-sown soybean fields in Jiangsu, China, were closely related to the time of immigration of the aphid vectors, with *A. glycines* the most frequent (40.3-94.8% of the total population). Zhang (1982) artificially infested soybean plants with alates of *A. glycines* and the incidence of the virus disease transmitted by this aphid reached almost 100% plant infectivity. D'yakonov (1975) showed *A. glycines* to be a vector in a non-persistent manner of soybean mosaic virus in the south of the Soviet Far East.

A. glycines is able to transmit abaca mosaic, beet mosaic, tobacco vein-banding mosaic virus, peanut stripe potyvirus, mungbean mosaic virus and bean yellow mosaic virus.

PHYTOSANITARY RISK

The main means of dispersal of *A. glycines* is wind-borne dispersal of the winged forms. Dispersal of aphids on plant material is of relatively minor importance. However, phytosanitary measures are important in preventing the spread of soybean mosaic virus, for which *A. glycines* is a vector. The virus is seedborne and infected seeds are often the main source of primary infection (Quimio and Calilung, 1993).

SYMPTOMS

Feeding on tender parts of young plants may result in stunted growth. Soybean infected with soybean mosaic virus has leaves with vein-clearing and chlorotic symptoms; plants become stunted with shortened petioles and internode lengths, and defoliation may lead to plant death (Quimio and Calilung, 1993).

Descriptors: Whole plant: dwarfing. Leaves: honeydew or sooty mould. Stems: external feeding. Growing points: external feeding.

MORPHOLOGY

A. glycines is a small yellow aphid with black siphunculi (Blackman and Eastop, 1985). Takahashi et al. (1993) presented biometric data, including body sizes: 1.89 mm for virginoparous aptera, 1.75 mm for virginoparous alata, 2.02 mm for gynopara, 1.5 mm for ovipara, 1.68 mm for alate males and 1.87 mm for both fundatrix and apterous fundatrigenia.

SIMILARITIES TO OTHER SPECIES

Takahashi et al. (1993) described the characteristic features of *A. glycines*, which could be used to separate it from other species; e.g. number of secondary rhinaria, number of caudal setae, length of siphunculi and length of last rostral segment.

DETECTION AND INSPECTION METHODS

Look for colonies in stem apices and young leaves of growing soyabean plants. On mature plants colonies are also found on undersides of larger leaves.

CONTROL

Chemical Control

Wang et al. (1993) reported results for different insecticides on seedling stages of soyabean in China. Significant control was achieved with phosalone, pirimicarb, omethoate and fenvalerate. Phosalone and fenvalerate were reported to cause less natural enemy mortality, whereas Qu et al. (1987) found that treatments of omethoate and fenvalerate at the seedling stage and diflubenzuron at the flowering and podding stages effectively controlled *A. glycines*, without harming most natural enemies. However, insecticides are usually ineffective at preventing the spread of non-persistent viruses as they kill the vector slowly.

Integrated Pest Management

Insecticides used in soyabean have different effects on natural enemy mortality (Wang et al., 1993) and appropriate insecticides should be used if natural control is to aid in pest management. Successful pest management has been achieved on soyabean using selective insecticides in conjunction with cultural control and resistant varieties.

Biological Control

A mass rearing programme for the predatory chrysopid *Mallada basalis* has been carried out in Taiwan for control of *A. glycines*. The coccinellid *Coelophora saucia* is a potential biological control agent with a life cycle synchronized to that of its host.

Host-Plant Resistance

Plant breeding programmes exist in China and Indonesia for development of soyabean varieties resistant to *A. glycines*. Sama et al. (1974) reported results for over 200 varieties screened in Indonesia. Plant breeding for resistance to soyabean mosaic virus transmitted by *A. glycines* has concentrated on cultivars with little or no seed transmission (Quimio and Calilung, 1993).

Cultural Control

Quimio and Calilung (1993) described cultural control practices that have been used in soyabean against *A. glycines*, including the planting of barrier crops (e.g. sunflower), the removal of weeds, roguing of infected plants and varying planting dates.

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